Report 99-206

passenger charter yacht *City of Dunedin*

grounding and fire

Bobs Cove, Lake Wakatipu

8 May 1999

Abstract

On Saturday, 8 May 1999, at about 1845, the passenger charter yacht *City of Dunedin* was on an overnight cruise from Queenstown, Lake Wakatipu when it grounded in Bobs Cove. During attempts to refloat the yacht, fire broke out in the engine housing. The skipper and 4 passengers on board were able to extinguish the fire before fire-fighters arrived by water taxi. There were no injuries.

City of Dunedin was approved to carry 19 passengers on day sails and 9 passengers on overnight cruises.

Safety issues identified included:

- the lack of a safety briefing for passengers before departure from the jetty
- lack of a compass to aid navigation
- allowing untrained and inexperienced passengers to take the helm unsupervised during a critical phase of the passage
- the continuation of a critical phase of the passage at a time when insufficient resources were available to do so
- incomplete investigation of an on-going engine exhaust problem.

Repairs and modifications were made to the yacht to eliminate specific safety issues. Safety recommendations were made to the owner of *City of Dunedin* to address operational safety issues.

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

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City of Dunedin **aground in Bobs Cove**

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List of Abbreviations

kW	kilowatt
m	metres
mm	millimetres
M&I	Marine and Industrial
NZST	New Zealand Standard Time (UTC + 12 hours)
rpm	revolutions per minute
SSMS	safe ship management system
t	tonnes
UTC	universal time (co-ordinated)

Glossary

aft	rear of the vessel
beam	width of a vessel
bulkhead	nautical term for wall
class	category in classification register
cockpit	space for a helmsman in yachts
command	take over-all responsibility for the vessel
companionway	stairs or ladder leading to a cabin
conduct	in control of the vessel
conning	directing the course and speed of a ship
deckhead	nautical term for ceiling
gross tonnage	a measure of the internal capacity of a ship; enclosed spaces are measured in cubic metres and the tonnage derived by formula
heel	angle of tilt caused by external forces
helm	device by which a rudder is controlled and the duty of controlling it
knot	one nautical mile per hour
leeway	sideways drift from the course steered, due to the effect of wind
list	angle of tilt caused by internal distribution of weights
port	left hand side when facing forward
schooner	fore and aft rigged sailing vessel having two or more masts
starboard	right hand side when facing forward
tiller	lever, attached to top of the rudder, by which steering is effected
trim	difference between the forward and aft draughts of a floating vessel

Marine Accident Report 99-206

Data Summary

Vessel particulars:

Name:	*City of Dunedin*
Port of registry:	Dunedin
Type:	two-masted sailing schooner
Class:	restricted limits passenger ship Class V
Operating limits:	enclosed water limit - Lake Wakatipu
Allowable passengers:	day trip: 19 overnight cruise: 9
Length (overall):	12.55 m
Gross tonnage:	23 t
Construction:	steel
Built:	in 1980 by the original owner in Twizel
Machinery plant:	one 39 kW Ford diesel engine driving a single fixed-pitch, 3-bladed propeller and providing electrical charging to two 12 volt battery packs
Owner:	Gibbston Valley Estates Limited and Hampstead Holdings Limited
Operator:	City of Dunedin Cruises

Location: Bobs Cove, Lake Wakatipu

Date and time: Saturday, 8 May 1999 at about 1845[1]

Persons on board: crew: 1
passengers: 4

Injuries: nil

Nature of damage: extensive to electrical switchboard, wiring, radio console and engine housing. Moderate to cabin furnishings

Investigator-in-Charge: Captain John Mockett

[1] All times in this report refer to NZST (UTC + 12 hours) and are expressed in the 24 hour mode

1. Factual Information

1.1 History of the trip

1.1.1 The *City of Dunedin* was a sailing schooner that worked out of Queenstown, providing sailing cruises on Lake Wakatipu. Passengers could pre-book cruises through local agents or arrange to join a cruise on a casual basis through the skipper at the jetty close to the town centre.

1.1.2 The service offered three 2-hour sails during daylight hours and an overnight cruise to Bobs Cove. The vessel was approved to carry 19 passengers on day sails and 9 on overnight cruises.

1.1.3 Throughout the day on Saturday, 8 May 1999, the skipper had been on the vessel at the town jetty trying to attract passengers for the sailing cruises. He had no success so the vessel remained alongside for most of the day.

1.1.4 At about 1630, the skipper noticed a group of 4 young people on the green near the jetties. He approached them and asked if they would like to take the overnight cruise. He explained the nature of the trip and left them to make their decision.

1.1.5 The group told the skipper that they would like to take the cruise and left the jetty area to collect their sleeping bags and overnight gear. The skipper went into town to purchase food for the evening meal, which was offered as part of the cruise. When the skipper and the 4 passengers returned, the yacht was quickly readied for departure.

1.1.6 At about 1650, with everyone back on board, the skipper conned *City of Dunedin* out into the main lake. There was a south-westerly wind of 15 to 20 knots, which precluded him sailing to Bobs Cove in reasonable time so he used the engine. The skipper did not give the passengers a safety briefing before departure.

1.1.7 Once clear of the jetty, the skipper tried to increase power on the engine but he was unable to do so from the cockpit controls. He put one of the passengers on the tiller, telling him to head out into the lake, and went below to the cabin and increased the rpm manually at the engine. He took a few minutes while he was below to rectify the throttle control problem before returning to the cockpit.

1.1.8 Once settled on a course for Bobs Cove, the skipper supplied a welcome-on-board drink for the passengers. The drink consisted of a mixture of rum and sherry and was provided in one glass which everyone, including the skipper, shared. The skipper used the routine to "get everybody together". If the passengers were able to guess the content, as they did on this occasion, they were supplied with a second drink. The skipper also shared the second drink with his passengers.

1.1.9 The passengers took turns on the tiller as the passage progressed. The skipper gave them little or no instruction, telling them simply to keep the bow into the wind to reduce the amount of spray. That course also kept the vessel heading towards the light on Mount Nicholas jetty, which the skipper found to be a convenient leading light for the approach to Bobs Cove (see Figure 1).

1.1.10 Between turns on the tiller, the passengers moved around the vessel, stowed their overnight gear away and sat together on deck and drank some wine they had brought with them. The skipper did not partake in the wine.

1.1.11 On passage, the passengers noticed that there was a distinct smell of diesel exhaust fumes in the cabin. One of the passengers later said that he had noticed the smell when he first boarded the vessel. The skipper had also noticed the exhaust fumes and had checked the engine each time he went below.

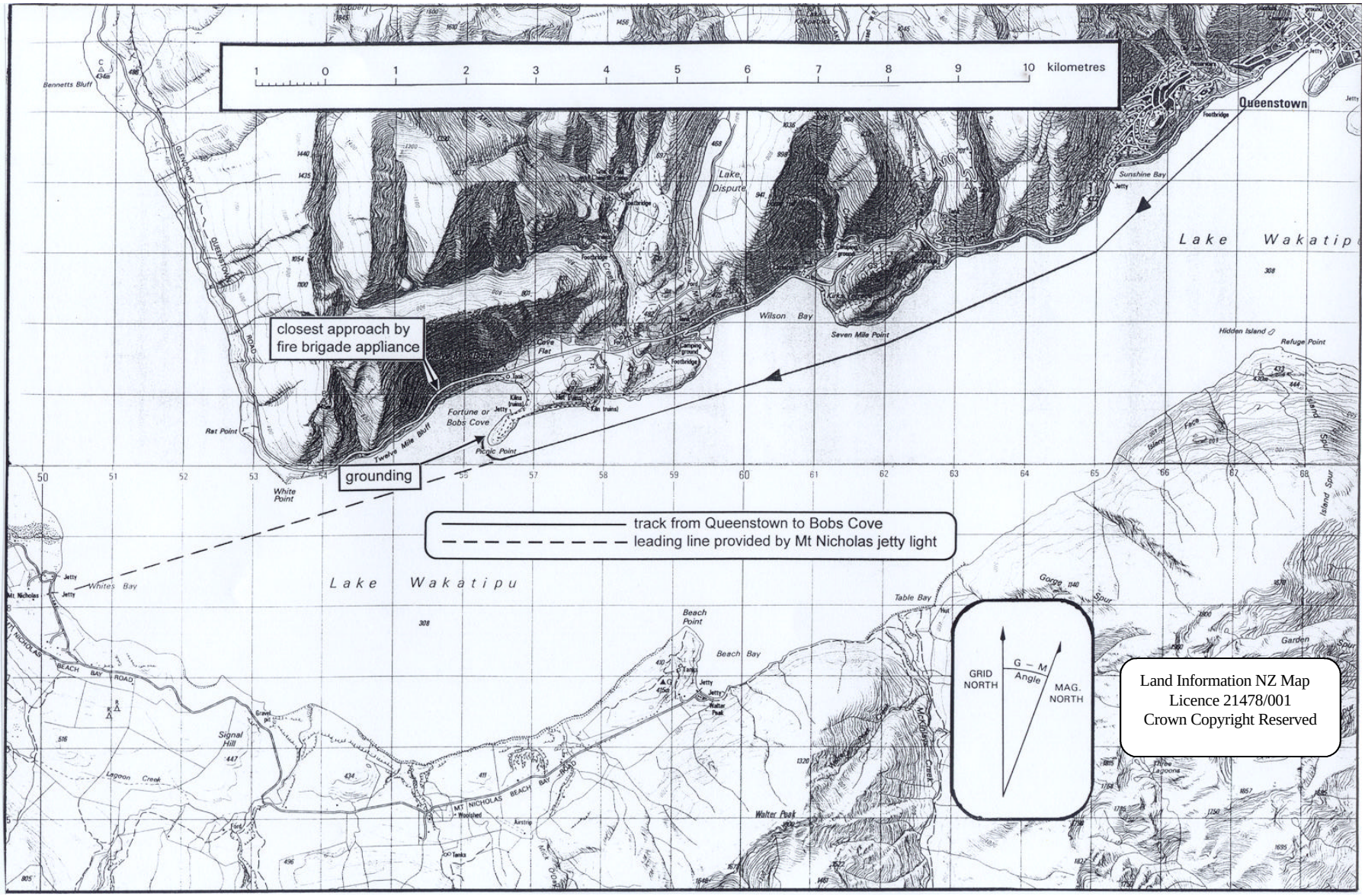

Figure 1
Location map

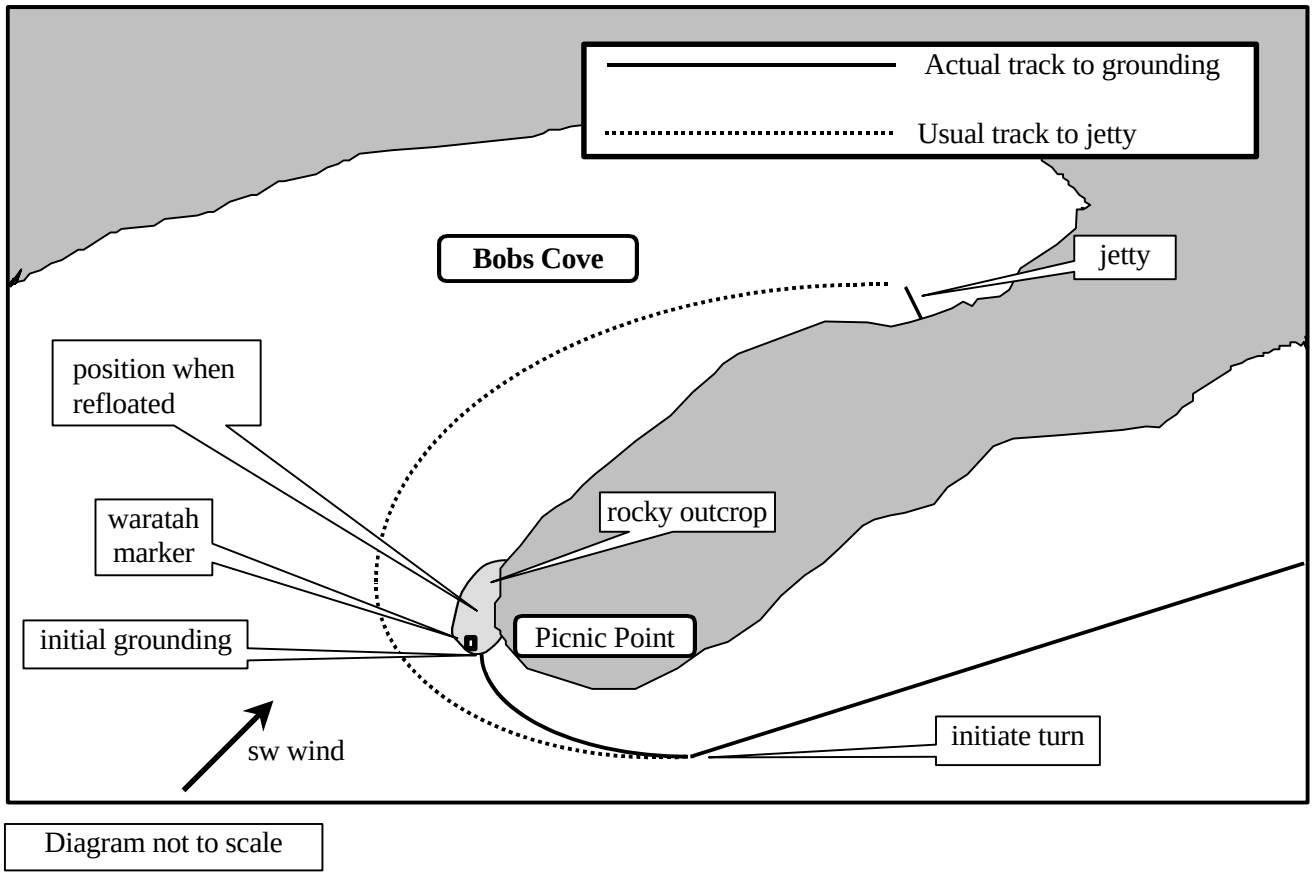

Figure 2
Diagram showing approximate track to Bobs Cove and the grounding position

1.1.12 As *City of Dunedin* approached Bobs Cove, the skipper indicated to the passengers the headland around which they would turn before tying up for the night. The time was about 1820 and it was quite dark. The skipper pointed out that the headland showed up as a lighter colour against the very dark backdrop of the higher hills beyond it.

1.1.13 About 10 minutes later, as the vessel was approaching Bobs Cove, the skipper noticed that there was an increasing amount of exhaust fumes, to the extent that he later described it as smoke. He helped the passenger that was on the tiller to initiate the turn to starboard around the headland (see Figure 2) and then went below, took the cover off the engine housing and checked that the engine was not overheating. He found nothing untoward despite the greater than usual amount of exhaust fumes.

1.1.14 While the skipper was below, the vessel grounded on a rocky outcrop. He immediately went back to the cockpit, leaving the cover off the engine. He took over the con of the vessel and put the engine into reverse and increased to full power. He instructed the passengers to move from side to side of the vessel to give it a list and possibly dislodge it from the rocks. He tried the engine ahead and various tiller movements. He also tried to trim the vessel more by the stern by getting all the passengers right aft.

1.1.15 The skipper had been using the engine at full power for about 7 to 8 minutes when he and the passengers noticed a lot of smoke coming up the companionway from the cabin. One of the passengers had been below and when he returned, mentioned the smoke to the skipper, who then stopped the engine and went below.

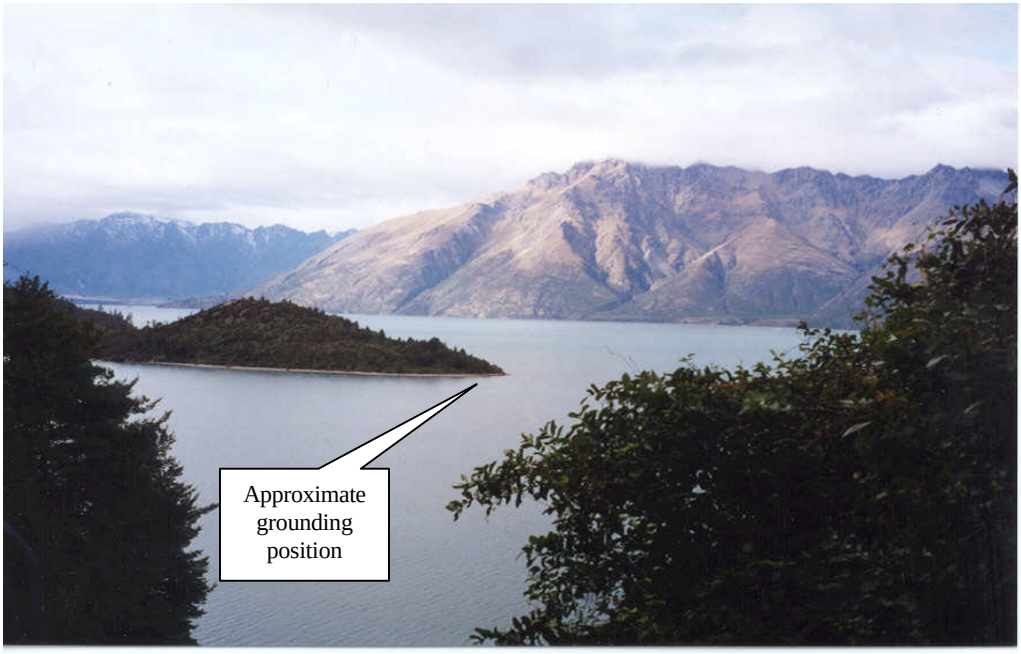

Figure 3
An overview of Bobs Cove from the Queenstown – Glenorchy road

1.1.16 The skipper found that the cabin was filling with smoke. He removed the engine housing box, the cover of which he had removed previously. With the engine fully exposed, he could still see no signs of fire around it.

1.1.17 At the aft end of the engine was a vertical wooden structure, which enclosed both the engine exhaust high-rise and the mainmast support. The structure went from the top of the engine housing cover to the deckhead, and incorporated a small shelf. Behind the mast support, the structure formed a bulkhead at the aft end of the cabin and also housed the electrical switchboard and radio console, which were accessed from the bottom of the companionway (see Figure 4).

1.1.18 The skipper noticed a "glow" high up and inside the wooden structure on the engine side. He went to the bottom of the companionway and saw a similar glow on that side. He saw smoke emanating from both sides of the structure at deckhead level.

1.1.19 The skipper took the fire extinguisher that was stowed at the bottom of the companionway and partly discharged it on the area above the electrical switchboard and radio console. He went into the cabin and discharged the remainder of the extinguisher to the area where he could see the glow within the wooden structure. He took the extinguisher from the galley area and party discharged that one also.

1.1.20 Although a lot of smoke remained, the skipper could no longer see the glow. Thinking he had at least taken control of the fire, he went back on deck to check on the passengers and the situation with the grounding. The vessel was still aground. The passengers were all right and eager to help.

1.1.21 Shortly afterwards there was "a big glow and a few flames" coming from the area above the switchboard. The skipper went below again and discharged the remainder of the second extinguisher. The smoke increased in volume and became thick and acrid, leading the skipper to believe that there was an electrical fire.

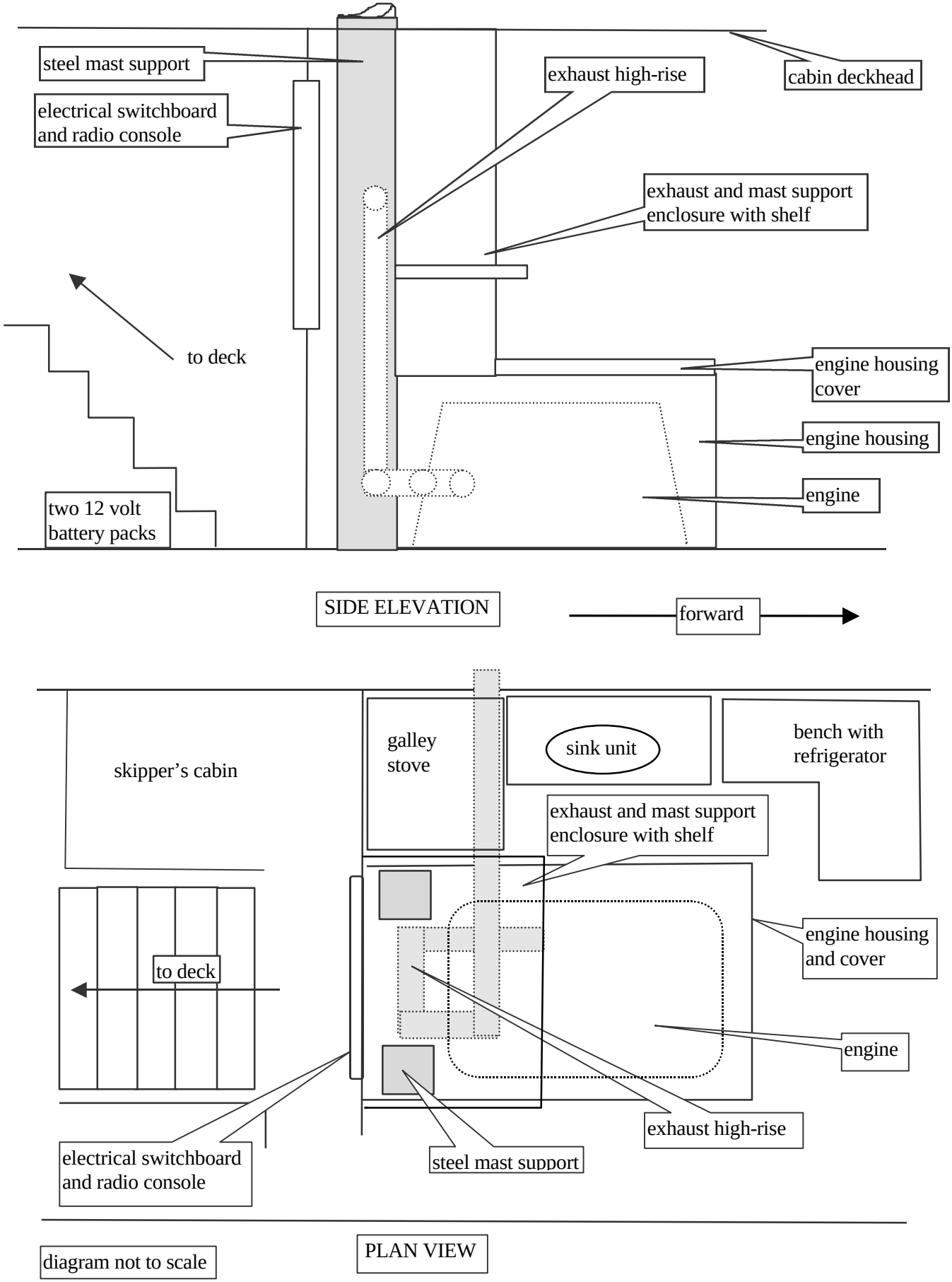

Figure 4
Plans showing layout of cabin in way of engine

1.1.22 While he was down below the skipper isolated the two 12-volt battery packs, which were situated under the companionway. The smoke became too thick for him to stay in the cabin so he took the remaining 2 extinguishers from a locker and went back on deck.

1.1.23 While the skipper was catching his breath, one of the passengers discharged an extinguisher through the companionway access onto the area of the switchboard where he could see flames.

1.1.24 The skipper went below once again and discharged the last of the extinguishers over the switchboard, still believing that the seat of the fire was in that area. When he returned to the deck, he took with him 2 fire buckets. He gave his mobile telephone to one of the passengers and told him to call 111 and advise the search and rescue services of their situation.

1.1.25 The skipper organised the passengers to collect lake water in the buckets and to throw it at the area above the switchboard where the flames were visible. Two of the passengers opened the forward hatch and removed their sleeping bags and other personal equipment. They then moved aft and opened the centre hatch.

1.1.26 The skipper and 2 passengers continued to throw water onto the fire at the switchboard but the fire kept re-igniting. The other 2 passengers started to throw water through the centre hatch. As the smoke began to clear, they were able to lean into the cabin and could see that flames were coming from the top of the wooden structure that enclosed the exhaust high-rise and mast support.

1.1.27 Fire-fighting efforts continued with water being thrown over the burning areas at the forward and aft ends of the wooden structure through the centre hatch and companionway. The two- pronged attack proved successful and the fire was eventually extinguished.

1.1.28 Meanwhile the fire service had dispatched an appliance to the scene, but it could approach no closer than the Queenstown - Glenorchy road above Bobs Cove. The skipper spoke to the fire officer at the appliance by mobile telephone and was told that 2 fire-fighters had been dispatched by water taxi from Queenstown to attend the grounded yacht.

1.1.29 The water taxi arrived in Bobs Cove shortly after the fire had been extinguished. The fire-fighters boarded the *City of Dunedin* and checked the cabin. Although the fire appeared to be out, they found one part of the wooden structure hot to the touch, so using the ships axe, they cut away the wooden cover and exposed the charred inner surfaces. They cooled the hot spot with water and satisfied themselves that the fire had been fully extinguished.

1.1.30 The water taxi was used in an attempt to refloat the *City of Dunedin*, however, it did not have sufficient power to move the yacht, and the attempt was abandoned. The fire-fighters and passengers returned to Queenstown on the water taxi that night.

1.1.31 The skipper remained on board *City of Dunedin* in case there should be any re-kindling of the fire or if the vessel should move in the increasing wind. The south-west wind got up to 45 knots overnight and the yacht was pushed further inshore, although on a less rocky part to the north-east.

1.1.32 Further unsuccessful attempts were made to refloat the yacht with the assistance of other craft during Sunday, 9 May. The yacht was eventually refloated on Monday, 10 May and towed back to Queenstown and moored at the Frankton marina for inspection and repair.

1.1.33 The safety officer for the Southern Region New Zealand Fire Service made an inspection of the fire scene on 12 May 1999. His report was used to assist in determining the sequence of the fire.

1.2 Post incident information

1.2.1 There was no damage caused to the hull by the grounding but the damage inboard caused by the fire was considerable. The switchboard and radio console were destroyed. The wooden enclosure of the exhaust high-rise and mast support suffered extensive fire damage on its internal surfaces. One section was destroyed by the fire-fighters when checking that the fire was fully extinguished. The cabin area had varying degrees of smoke damage.

1.2.2 The high-rise section of the exhaust was found to be distorted. Originally the pipe was centrally located within the mast support structure. After the fire it was found to be distorted to starboard and forward of the mast support. With some effort the pipe could be pushed back between the legs of the mast support but in this position it rested hard against the inside of the starboard leg (see Figures 5 and 6).

1.2.3 The surface of the mast support where the exhaust pipe had been resting hard against it was worn smooth. The area of the exhaust pipe that had been chaffing on the mast support was the outside of a 65 mm right angle elbow joining the transverse and down sections of the pipe. The rounded elbow had been worn flat by the contact with the mast support (see Figures 5 and 6).

Figure 5
Photographs showing displaced exhaust and worn area of pipe

1.2.4 The worn area was so thin that pin holes were evident. When the centre of the area was touched lightly with the blade of a knife, the centre of the worn area fell away producing a hole about 10 mm in diameter.

1.2.5 The wooden enclosure of the exhaust high-rise and mast support was constructed of marine plywood overlaid with a tongue-and-grooved facia. The marine plywood was extensively burnt and showed a distinctive burn pattern. There was a circular area on the starboard side where the plywood was completely burnt away, indicating that the fire had been seated there (see Figure 7).

1.2.6 The centre of the burnt circular area was 490 mm from the bottom of the enclosure and 220 mm from its aft end. Those measurements coincided exactly with the position of the worn hole in the exhaust pipe as it was found after the fire (see Figure 7).

1.2.7 The fire appeared to have moved up and across the forward panel of the enclosure to the deckhead above. The internal surfaces of the enclosure were extensively burnt. There was a panel aft of the mast support that separated the engine bay from the back of the switchboard and radio console. The panel did not reach fully to the deckhead and the fire had crossed over the top of the panel into the switchboard (see Figure 8).

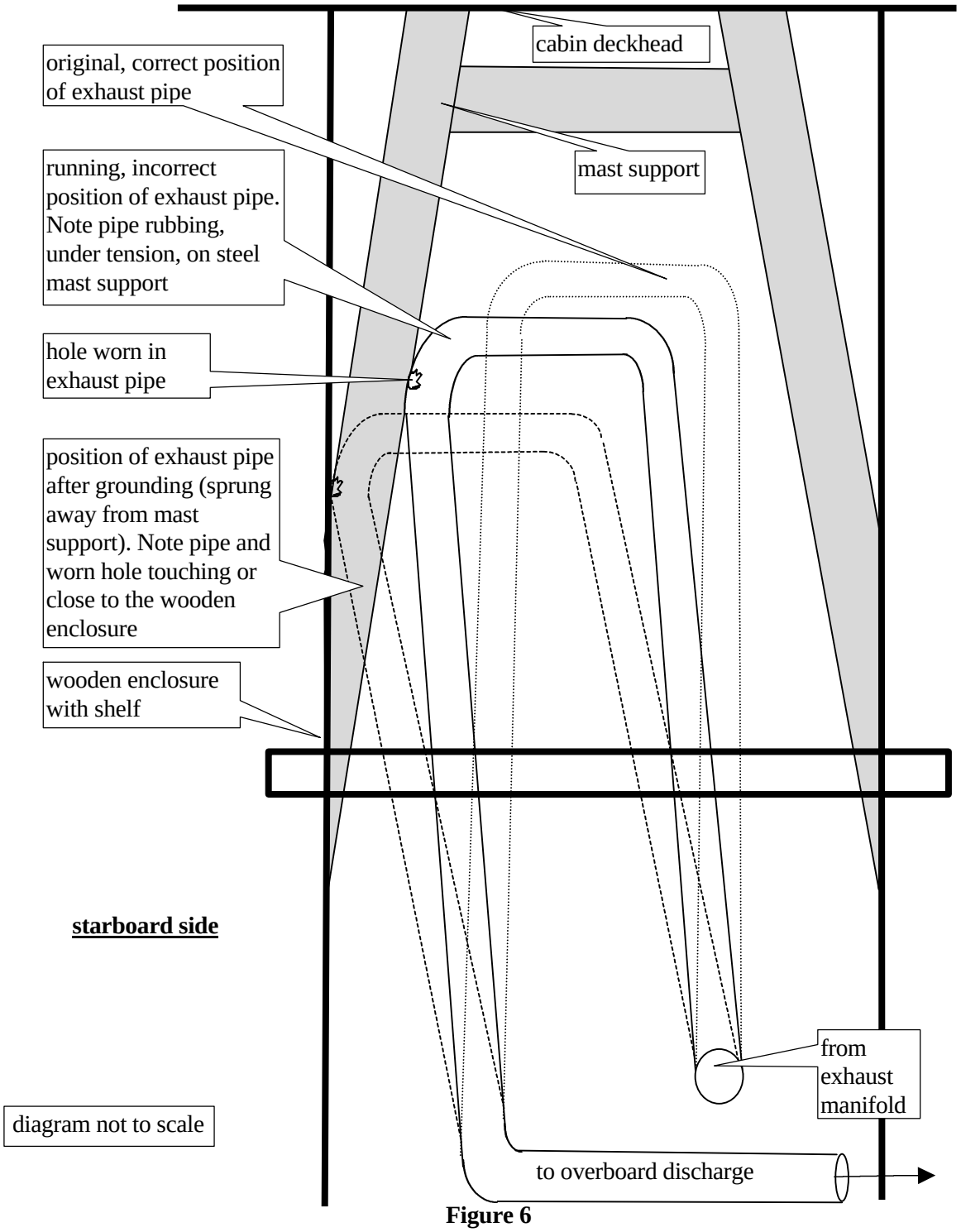

Figure 6
Front elevation showing exhaust pipe positions; designed original, as running and after grounding. Hole worn in exhaust pipe indicated to show the positions where formed and after grounding

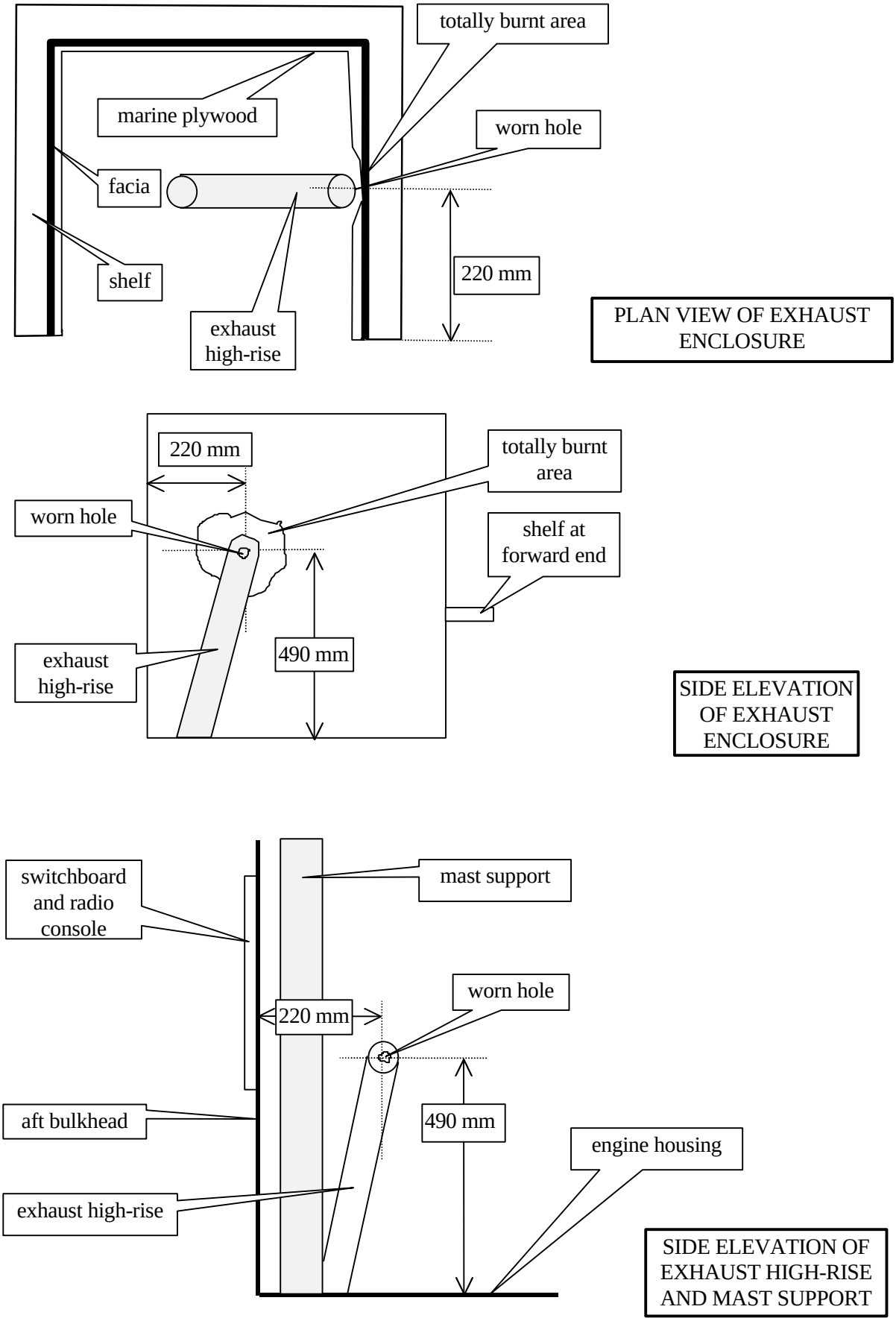

Figure 7
Diagram showing relationship between position of worn hole and seat of fire

Figure 8
Photographs showing fire damage to inside of engine exhaust enclosure and switchboard

1.3 Site information

1.3.1 Lake Wakatipu is situated in the south of the South Island. The lake is generally deep and fed from mountain rivers and streams. In Bobs Cove there is a rocky outcrop off Picnic Point. At the south-west end of it the largest rock was marked by a waratah[2], the top of which was covered with reflective tape. The area to the north-east of the waratah is more sandy and shelves to the shore.

1.3.2 When approaching Bobs Cove from Queenstown a starboard turn has to be made around Picnic Point to approach the jetty within the cove. The waratah was positioned about 25 m off the shore and after passing it a vessel had an unrestricted run to the jetty.

1.3.3 On the night of the grounding, the skipper had not told the passenger on the tiller about the waratah or its significance. He had shown him generally where the yacht was headed but simply told the passenger to keep heading around the point. When the skipper returned to the cockpit after the grounding, he noticed that the waratah was about 3 metres ahead of the yacht and about 4 metres to port of the centreline.

[2] A Y-shaped steel bar, often used as a fence post

1.4 Navigation and routine information

1.4.1 For the 2-hour day sails, the skipper sailed out into Lake Wakatipu in whichever was the favourable direction with regards to the wind conditions and to give his passengers the best possible scenic experience. The overnight cruise to Bobs Cove was normally made under sail if the wind was favourable and time was available, otherwise the engine was used.

1.4.2 There was no marine chart of the lake available so the skipper relied on his local knowledge for navigation. Having made an estimated 1400 trips from Queenstown to Bobs Cove, he felt that even had a chart been available, he would not have needed to use it.

1.4.3 The yacht was not fitted with a compass so all the skipper's navigation was by visual means. With his extensive experience on the lake, he felt he had been able to readily identify the position of the yacht at any time and to monitor its progress by visual transits and leading lines, except on the very few occasions when reduced visibility had been encountered.

1.5 Vessel and maintenance information

1.5.1 *City of Dunedin* was home-built in Twizel by the original owner and launched in 1981 as a pleasure craft. It was constructed of steel. The yacht went through a succession of ownerships until 1987, when it was transported to Queenstown and began operating on Lake Wakatipu. The current skipper had operated the yacht since 1989. The current owner acquired the yacht in 1996.

1.5.2 *City of Dunedin* was a surveyed vessel for the purposes of the commercial operation. At the advent of the Safe Ship Management System (SSMS), the vessel was entered into a SSMS with Marine and Industrial Safety Inspection Services (M&I). The safety manual for the yacht was dated 19 September 1997 and the certificate dated 30 March 1998 with an expiry date of 31 December 2002.

1.5.3 Where possible, the skipper carried out maintenance on the yacht. When the required tasks were beyond his capabilities, he used local marine engineering companies.

1.5.4 On the day of the grounding and fire, exhaust fumes in the cabin were the first indication that there was a problem. The passengers later stated that the cabin smelt of exhaust fumes when they first boarded the yacht. The skipper later stated that he had not been too perturbed because there was a history of exhaust fumes and slight smoke over the years.

1.5.5 The engine exhaust exited from the manifold and passed through a water cooler before entering the overboard discharge pipe. The exhaust system included a high-riser intended to keep the highest point of the system above the waterline even when the yacht was heeled under sail.

1.5.6 The high-rise section of the exhaust was designed as a vertical construction that was positioned between the legs of the mainmast support structure. There were no brackets holding it in position and it appeared that there never had been. The connection between the manifold and water cooler to the exhaust pipe consisted of a heavy-duty rubber sleeve.

1.5.7 Over a period of years, various maintenance had been carried out on the exhaust system. The sleeve connection to the engine was thought to have been a modification rather than an original fixture.

1.5.8 Although the enclosure of the exhaust high-rise was secured in place, the skipper could recall no occasion when it had been taken down, in spite of a history of exhaust fumes and smoke being present in the cabin of *City of Dunedin.*

1.6 Personnel information

1.6.1 The skipper of *City of Dunedin* first went to sea in the Royal Navy in 1951 and served in the seaman branch for 12 years. During his training he learnt to sail and after leaving the Navy he continued recreational sailing in boats ranging from small dinghies to 12-metre racing yachts. He had sailed around the British Isles, the Mediterranean, South Africa and New Zealand.

1.6.2 After settling in Queenstown in about 1985, he initially part owned and operated a commercial jetboat company. During that time he obtained Local Launchmaster Licence and Commercial Launch Master certificates. He later became skipper of a hydrofoil operating on Lake Wakatipu. When the *City of Dunedin* started operating on the lake, he worked as part-time skipper and later full-time skipper, a position he held for 10 years prior to the grounding and fire.

1.6.3 None of the 4 passengers had any marine expertise.

1.6.4 The owner of *City of Dunedin* was a property developer and acquired the yacht as part of a property trade deal. The yacht was jointly owned by Gibbston Valley Estates Limited and Hampstead Holdings Limited. The parent company of Gibbston Valley Estates Limited owned land at Bobs Cove under the name of Bobs Cove Developments Limited. The development company intended to establish a fishing lodge at Bobs Cove with the *City of Dunedin* being used to transport passengers and provide sailing cruises.

1.6.5 Because the owner of *City of Dunedin* had no maritime experience, either operational or managerial, the responsibility for the operation of the yacht was placed with the skipper. The owner stated that he treated the skipper "as an owner/operator". The skipper maintained a bank cashflow account into which the yacht earnings were placed and from which maintenance costs and operational expenses were taken. The operation was not financially successful enough for the skipper to take enough salary to make a living; nor were any profits transferred to the owner.

1.6.6 Business had been slow for the few days before the grounding. There had been no day sails during Saturday, 8 May. There had been no day sails or night cruises on Thursday or Friday of that week. On the Wednesday there had been one day sail and an overnight cruise. Although there had been little business the skipper had been at the jetty for most of the days trying to attract custom and doing maintenance tasks on the yacht.

1.6.7 Additional to running the *City of Dunedin*, the skipper also ran a small business for the distribution of circulars. The task involved him and his children in folding the circulars in preparation and the physical time taken for actual distribution. The skipper generally acted as driver for the distribution exercise. The work involved a few hours each day and was not physically demanding.

1.6.8 The skipper had the responsibility for the full running of his household including 4 children, the youngest of whom was 10 years old. His wife was seriously ill, spending more time in hospital than at home. The skipper had spent several hours each day tending to his wife's needs both at the hospital and at their home.

2. Analysis

2.1 The grounding

2.1.1 During cruises, the skipper encouraged passenger involvement by allowing them to take the helm. On the accident trip each of the 4 passengers took a turn at the helm. He conned the yacht away from the jetty and thereafter one or other of the passengers was at the helm. When the *City of Dunedin* approached Bobs Cove, the skipper pointed out the headland at the entrance to the Cove and told the passenger at the helm that a starboard turn had to be made around it.

2.1.2 The skipper assisted the passenger to initiate the turn and then told him to continue on around the headland while he went below to check the engine.

2.1.3 While it may have been appropriate for the passengers to steer the yacht under the skipper's supervision, it was not appropriate for them to do so unsupervised, particularly at a critical part of the passage, especially when they had been consuming alcohol.

2.1.4 The skipper was aware of the rocky outcrop and the waratah marking it but did not pass that information on to the passenger. The passenger continued with the turn, keeping the tiller in the same position as it had been when the skipper left. He did not know what he should look for or which side of the waratah he should pass if he had seen it.

2.1.5 The turn continued in an arc which was tighter than the skipper would normally have used but the passenger would not have known anything was amiss. The tight turn brought the yacht too close to the headland and inside the waratah marking the rocky outcrop.

2.1.6 When the skipper became concerned about the exhaust fumes, it would have been prudent for him to have slowed the yacht and delayed the turn while he checked the engine. He could then have returned to the cockpit and safely monitored the turn into the cove even with one of the passengers remaining at the helm.

2.1.7 The south-west wind of about 20 knots might also have caused some leeway, pushing the yacht closer to the headland.

2.1.8 In view of the low workload with *City of Dunedin* in the 4 days prior to the grounding and fire, fatigue was not considered to have contributed to the accident despite the skipper's involvement with his circular distribution business. However, the skipper's responsibilities towards his children and his concerns regarding his wife may have led to a degree of distraction and pre-occupation with matters other than the operation of the *City of Dunedin*.

2.1.9 The skipper's routine of sharing a welcoming drink with his passengers probably had the desired effect of putting the group at ease. Because the drink was shared from a single glass, it could not be established exactly how much alcohol the skipper consumed, but the amount was unlikely to have significantly affected his judgement. However, it was unwise of him to have shared their second drink, while in command of the yacht.

2.2 The fire

2.2.1 The switchboard and radio console were completely destroyed. The external insulation on most of the wiring had either been burnt or melted in the fire. Plastic components of the switchboard and radios had also been burnt or melted. The wooden housing of the radios had burnt leaving the damaged components hanging by remaining wiring.

2.2.2 The immediately obvious electrical damage on entering the cabin through the companionway re-inforced the skipper's initial thoughts that the fire had been started by some electrical fault within the switchboard. Inspection of the fire damage within the engine and exhaust housings suggested that the seat of the fire had been on the engine side.

2.2.3 The safety officer of the Southern Region New Zealand Fire Service was requested to inspect the yacht and he made his inspection on the morning of Wednesday, 12 May 1999. He concluded that the fire had started on the internal surface of the starboard side of the exhaust and mast support enclosure where the hot exhaust pipe had been close to, if not touching, the wooden surface and where hot exhaust gases had been escaping through the worn part of the exhaust pipe in that area.

2.2.4 Extracts of the Safety Officer's report are quoted below:

- Supposed Cause: exhaust system displaced, heating engine bay surrounds to ignition temperature following grounding.
- Burn patterns indicate fire originating in engine bay, around point of contact between exhaust and engine cowling.
- Exhaust had been rubbing on the mast supports for some time, as evidenced by the amount of wear on the elbow of the exhaust.
- Wiring and fuses were checked, and while not in the best of condition, it showed signs of fire having entered this area, rather than having originated here.

2.2.5 At the time of the grounding there was no fire. The skipper had checked the engine during the passage and found that it was not overheating and no exhaust leaks were obvious to him around the engine.

2.2.6 The exhaust high-rise pipe had been rubbing against the mast support for some time; long enough for the side of the right-angled elbow joint to have worn flat and for pinholes to develop allowing exhaust gases to escape from the worn area. The worn area was enclosed in a wooden structure and would not have been visible without removal of the cover.

2.2.7 The wear was caused by vibration of the exhaust pipe against the mast support when the engine was running. The pipe was held against the mast support under tension. When the yacht grounded, the jolt was enough to spring the exhaust pipe free of the restraining mast support. Once free, the worn area was very close to the plywood surface of the enclosure. Without the flat surface of the mast support covering the worn area, the exhaust gases would have escaped more readily through the pinholes in the metal.

2.2.8 The inner plywood surfaces of the enclosure would have been very dry due to the rise of warm air from the running engine below it. The wooden surface would also have been impregnated with oily residue from the atmosphere associated with a running diesel engine, particularly as the exhaust had apparently been leaking for some time.

2.2.9 When the exhaust pipe was jolted free of the mast support, the movement would have produced an unusual noise, but it was probably masked by the overall noise of the grounding. The movement of the exhaust pipe would not have been visually obvious to the skipper as it was within the enclosure. Having no indication of the problem, he left the cabin and went immediately to the cockpit.

2.2.10 The skipper took over control in the cockpit and put the engine astern and increased to full power. The engine had been running for about 90 minutes for the trip from Queenstown and was already at normal working temperature. The full-power running while attempting to free the yacht would have increased the exhaust temperature. The exhaust pipe would have become very hot, despite the water-cooling system.

2.2.11 The fire started on the plywood at the point of contact with the exhaust pipe. The burn patterns indicated that the fire spread upwards around the starboard and forward inner surfaces of the enclosure and set alight the deckhead within the structure. It then moved through to the aft end where the switchboard and radio console were housed.

2.2.12 The smoke associated with the burning in the switchboard and radio console became thick and acrid alerting the skipper and passengers to the fire. Because the worst of the smoke was coming from the switchboard area and the distinctive smell of burning insulation, the skipper assumed the fire was electrical so he initially concentrated fire-fighting efforts in the area of the switchboard.

2.2.13 Each time the fire was apparently extinguished it re-kindled because the seat of the fire was actually within the engine enclosure and not within the switchboard.

3. Findings

Findings and safety recommendations are listed in order of development and not in order of priority

3.1 The *City of Dunedin* was operating under a valid safe ship management system and had a current maritime document at the time of the accident.

3.2 The crewing of the *City of Dunedin* was appropriate for the trip undertaken.

3.3 The skipper held the required qualification to command *City of Dunedin*.

3.4 The *City of Dunedin* was not fitted with a compass, which contravened the Ships Compasses Regulations 1971, and made navigation by visual means a necessity.

3.5 The skipper felt he was sufficiently experienced to safely navigate on Lake Wakatipu by visual means alone; however, without a compass he was deprived of an essential piece of navigational equipment, particularly when navigating in poor visibility or at night in an area of limited navigational and background lights.

3.6 The instructions given to the passengers when they took the helm were not sufficient for them to safely navigate by visual means alone.

3.7 While it may have been appropriate for passengers to take the helm under supervision, the skipper should have either closely monitored their actions or taken the helm himself at critical times of the passage.

3.8 To continue with the approach into Bobs Cove while attending to an unusual event was not a prudent course of action.

3.9 The passenger who was left to con the *City of Dunedin* during the approach to Bobs Cove did not have appropriate experience for the task, and had been consuming alcohol.

3.10 The *City of Dunedin* grounded during an unmonitored approach into Bobs Cove.

3.11 The jolt of the grounding caused the exhaust high-rise pipe to spring out from the mast support where it had been wedged.

3.12 The exhaust pipe had been wedged against the starboard leg of the mast support for some considerable time, allowing vibration to wear the pipe flat and produce pinholes in the remaining material.

3.13 The fire was caused by the hot exhaust pipe and exhaust gases escaping from a hole in the exhaust pipe contacting the dry and oil-impregnated plywood of the enclosure.

3.14 The fire progressed within the wooden structure and passed through to the after end setting alight the switchboard and radio console.

3.15 The resulting thick and acrid smoke led the skipper to believe that the fire was electrically originated, a view that was supported by the smoke and eventually flame emitting from the area above the switchboard.

3.16 There had been a history of exhaust fumes in the cabin of *City of Dunedin* but the skipper had not discovered the cause.

3.17 It would not normally be necessary to remove the structure enclosing the exhaust high-rise for routine maintenance but given the history of exhaust problems, removal of the cover would have been a prudent measure in the search for faults.

3.18 Had the skipper found and rectified the on-going exhaust problems, the grounding and subsequent fire probably would not have occurred.

3.19 The fire-fighting techniques employed by the skipper and passengers were generally well thought out and effective.

3.20 Because the fire directly affected the radio console, the skipper was unable to raise the alarm or call for assistance by radio. The use of a mobile telephone to call emergency services was timely and appropriate under the circumstances.

4. Safety Action

4.1 After the accident the exhaust high-rise was renewed using stainless steel and bracketed into position to eliminate movement.

5. Safety Recommendations

5.1 On 24 September 1999 it was recommended to the director of Gibbston Valley Estates Limited that he:

5.1.1 amend the Ship Safety Manual for *City of Dunedin* to include an inspection of the complete engine exhaust system in the Vessel Annual Maintenance Plan (052/99)

5.1.2 fit a compass in the *City of Dunedin* to assist with navigation, as required by the Ships Compasses Regulations 1971 and amend the equipment list in the Ship Safety Manual accordingly (053/99)

5.1.3 enforce the operations policy requiring a safety briefing for passengers before departing the wharf and include a requirement to give appropriate instructions to passengers should they be given the opportunity to take the helm (054/99)

5.1.4 adopt a policy whereby passengers are allowed to take the helm only:

- under strict supervision
- during non-critical sections of the passage
- when not under the influence of alcohol (055/99).

5.2 On 18 October 1999 the director of Gibbston Valley Estates Limited responded as follows:

> 5.2.1 we confirm that we intend to adopt the safety recommendation[s]. The skipper has been advised of the requirements for safety briefings and policy for passengers taking the helm. The compass and alternations to the Manual will be completed once the vessel is back in the water and before going back into service.

Approved for publication 6 October 1999

Hon. W P Jeffries
Chief Commissioner